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**Renewables and Carbon Constraint:  
Challenges Presented by Federal  
Policy Initiatives**

Presented to the South Carolina Public  
Service Commission  
February 27, 2008

# Main Points for Today

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- South Carolina is different.
- The real cost of “cap-and-trade.”
- Attempts at predicting the future.
- The Co-op message to Congress.

# Inconvenient Truths

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# Challenge to Lower Income Families

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- Compared to other states, South Carolina has a large number of households earning less than \$25,000 per year.
- 22% of South Carolina electric cooperative members make less than \$25,000 per year (compared with 15% nationally).



# Challenge to Lower Income Families

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- According to Consumer Reports, the highest efficiency washer costs \$1,500 (rating of 83). The least efficient washer costs \$360 (rating of 20).
- For a typical home solar panel system, upfront capital costs to install a system able to provide 50% of home's average needs will exceed \$20,000.
- Truth: Many South Carolinians will be asked to make choices among life's necessities (food, medicine, and electricity).



# Challenge to Our Climate

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- Because of S.C.'s climate (four seasons and high heat and humidity) and greater reliance on electricity, an average South Carolinian's monthly use of electricity is 100% higher than the average Californian or New Yorker.
- It is approximately 50% higher than the average Ohioan or Minnesotan.
- Truth: With conservation goals, one size does not fit all.



# Challenge of Our Growth

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- Over the last decade, our state has been a magnet for growth – both residential and industrial.
- Our electric cooperative system has grown at an average annual rate of 4.74%.
- This is double the national average.
- Truth: S.C. cannot afford to close its doors and say “no” to growth.



# Challenge to Keep Jobs

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- For the past 10 years, South Carolina has lost manufacturing jobs at a rate 50% higher than the nation as a whole. (27% of total versus 18% of total).
- Truth: Higher energy costs will only cause manufacturers to flee S.C. more quickly for locations in India and China where environmental compliance is not a priority.





# What if Cap-and-Trade is Adopted?

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## Our unique challenge:

- Avoiding the tyranny of the “either/or.”
- Danger - appearing obstructionist, “selling fear”
- Problem will never be solved if we ignore the complexity.

# What if Cap-and-Trade is Adopted?

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## What do experts say?

- Dr. Anne E. Smith of CRA, International (formerly known as Charles Rivers Associates). 
- Appeared before the U.S. House of Representatives Budget Committee in November.



# What if Cap-and-Trade is Adopted?

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- According to Dr. Smith, the annual redistribution of wealth caused by the pending Lieberman-Warner Climate Change legislation (S.2191) will be between \$150 and \$500 billion.



# What if Cap-and-Trade is Adopted?

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Equal to our total current annual outlay for:

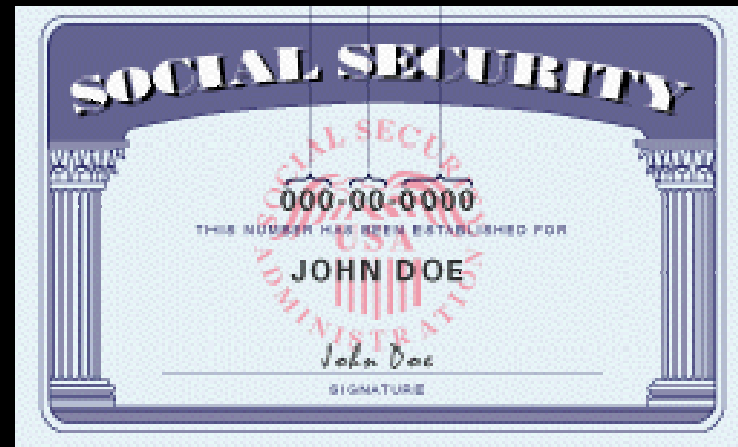
- The Department of Defense or



# What if Cap-and-Trade is Adopted?

Equal to our total current annual outlay for:

- The Department of Defense or
- One-half of our total annual Social Security system payout.



# What if Cap-and-Trade is Adopted?

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## Will also lead to:

- Manufacturing process changes driven by fuel costs,
- Losses of whole sectors of employment,
- Consumer behavior driven by marked shifts in product costs, and...
- A heavy hit on our nation's trade balance.

# What if Cap-and-Trade is Adopted?

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## CRA's "Computable General Equilibrium Model"

- An attempt to analyze the effects of economic signals required to produce movement (tariffs).
- If all variables (technology, natural gas prices, and available cap offsets) fall in place at optimum levels:
- The per ton tariff on CO<sub>2</sub> emissions under Lieberman-Warner could range between \$35 in 2015 to more than \$150 in 2050



## What if Cap-and-Trade is Adopted?

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- Conversely, the range of the per ton tariff for less-than-optimum conditions:
- \$50 per ton in 2015 to nearly \$350 per ton in 2050.





# What if Cap-and-Trade is Adopted? Impact on Fuel Choice

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Under the same economic model, a modest \$30 per ton tariff on CO<sub>2</sub> will result in:

- a) no new investment in coal-fired generation without carbon capture and storage technology (CCS),
- b) the shut down of most existing coal-fired generation units and
- c) greatly reduced investment in environmental retrofits on existing coal units.

# What if Cap-and-Trade is Adopted? Impact on Wholesale Price of Power

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- Optimum circumstances - model projects wholesale electricity prices (nationwide average) to range from 35% higher in 2015 to 85% higher in 2050
- Less than optimum circumstances - nearly 70% higher in 2015 to over 125% higher in 2050.
- These increases are in 2007 dollars (exclusive of inflation).



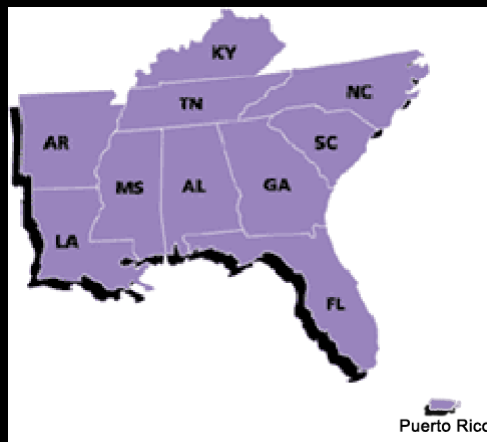
# What if Cap-and-Trade is Adopted? Impact on Our Economy

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- Household spending power will be reduced between a range \$1000 in 2020 to nearly \$3000 in 2050.
- Overall our (U.S.) Gross Domestic Product will drop one to two percent.

# What if Cap-and-Trade is Adopted? Impact on Our Region

- The impact on the Southeastern United States (with more coal, less renewables) will be far more drastic.



# What if Cap-and-Trade is Adopted?

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## Tyranny of the Either/Or.

# Our Bottom Line

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- Climate change (cap-and-trade) legislation will produce economic winners and losers.
- The co-op communications effort in Washington will be threefold:



# Our Bottom Line

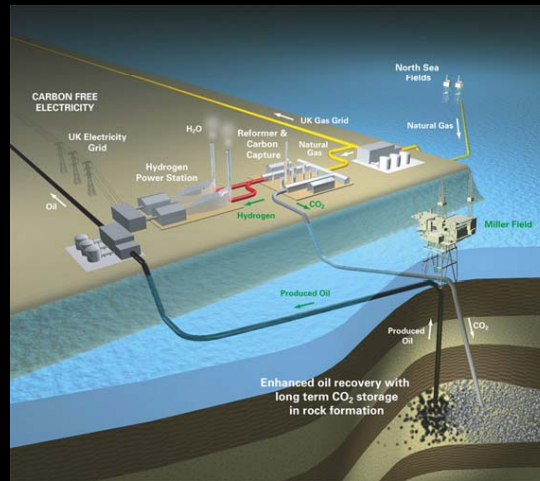
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- 1) Allocation of credits must recognize the “inconvenient truths” facing S.C. co-op and members.



# Our Bottom Line

- 2) The cap must not tighten faster than technology is able to create viable and affordable generation options.





# Our Bottom Line

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- 3) Must incentivize and fast-track construction of nuclear generation. The keys will be:
  - creation of “safe harbors” for early investment.
  - A focus on safe, available nuclear waste storage.



# How About the Rest of the World?

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# How About the Rest of the World?

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- Climate change is a global problem.
- The U.S. did not cause this problem by itself.
- It cannot solve this problem by itself.
- Again- what do experts say?



# Possible Global Scenarios

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- Cambridge Energy Research Associates (CERA).
- Advises international energy companies, governments, financial institutions, and technology providers.



# Possible Global Scenarios

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- CERA delivers independent analysis on energy markets, geopolitics, industry trends, and strategy.



# Possible Global Scenarios

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- Helps decision makers anticipate the energy future and formulate timely, successful plans in the face of rapid changes and uncertainty.



# Possible Global Scenarios

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- CRA's macro-regional view is bolstered by CERA's macro-global analysis.
- Robert LaCount, a senior director at CERA, has offered a broad perspective in three different areas:



# Possible Global Scenarios

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- (1) how other nations view the United States' "relative responsibility" for climate change,
- (2) different global economic scenarios that might unfold over the next several decades, and
- (3) the projected impact of pending federal climate change legislation on generation plant construction and fuel costs.



# Possible Global Scenarios

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- Taken together, LaCount's views lead to the same conclusion many in the South Carolina cooperative family have believed:
- Without new nuclear or dramatic advances in technology, the future for affordable and reliable electricity in our state is bleak.

# Is the U.S. Really the Bad Guy?

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- Of the 27 billion metric tons of CO<sub>2</sub> emitted globally each year, approximately:
  - 10 billion metric tons- burning of coal.
  - 10 billion metric tons- burning of oil.
  - 7 billion metric tons- burning of natural gas.
- Globally, the electricity and heat sector emits about 40% of this total.

# Is the U.S. Really the Bad Guy?

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- The United States is the single largest CO<sub>2</sub> emitter, but China is on the threshold of surpassing us.
- Together, China, the U.S. and the European Union emit about 60% of the total global CO<sub>2</sub> emissions.



# Is the U.S. Really the Bad Guy?

- On a per capita basis, the U.S. emits approximately **20 tons** of CO<sub>2</sub> per person annually.



- Other approximate per capita emissions:

- European Union and Japan – 10 tons,

- China – 5 tons



- India – 2 tons.

# Is the U.S. Really the Bad Guy?

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- An interesting calculation offered by CERA is “how much GDP does each country achieve per ton of CO2 emitted?”
- U.S., Canada, and China’s economies are among the least efficient.



# Is the U.S. Really the Bad Guy?

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- For each million U.S. dollars of GDP achieved, approximately 700 tons of CO<sub>2</sub> is emitted.



- The European Union, Japan, and India average approximately 400 tons of CO<sub>2</sub> in emissions per million U.S. dollar of GDP.



# Why Look at These Numbers?

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- The rest of the world is looking.
- Recent global negotiations - a blame game.
- U.S. says “China is soon to be the largest emitter and is by far the most indiscriminant polluter.”
- China: U.S. has the highest per capita emissions total and one of the lowest economic efficiency totals (emissions to dollars of GDP).



# Why Look at These Numbers?

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- Global pressure (and the 2008 presidential campaign) affects the process.
- U.N. Climate Change Conference (Bali, Indonesia December 3-14, 2007).





# Why Look at These Numbers?

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- Congressional leaders pushed forward legislation – the Energy Act of 2007 – to reassure international attendees that the U.S. was willing to “get serious.”



# Why Look at These Numbers?

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- Summary - global perception is having an effect in Washington.
- Co-ops believe that Congress must take expert views like CERA's into account.



# CERA's Global Models

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- CERA recently offered three possible 30-year global scenarios for the electricity and heat sectors.



# CERA's Global Models

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## 1. CERA's "Asian Phoenix":

- Asia becomes an economic force and there is no global consensus as to how to respond to climate change.
- Imagine China and India with no pollution controls.



# CERA's Global Models

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## 2. CERA's "Break Point" scenario-presumes:

- high oil prices due to continued Middle East petroleum hegemony and
- strict and costly carbon tariffs rising steadily in price.



# CERA's Global Models

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## 3. CERA's "Global Fissures" scenario:

- massive and global economic slowdown where energy demand and long-term investment in the energy industry plummets.
- imagine a cataclysmic recession that elevates economic concerns over environmental concerns.



# CERA's Global Models

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## What did CERA's modeling show?

- None of the scenarios predict global annual CO2 emissions to fall back to 1990 levels (the target of many legislative proposals, including Lieberman-Warner).
- In fact, the most aggressive result, achieved under the Break Point scenario, only marginally slows CO2 emissions' growth.



# CERA's Global Models

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- Under the Break Point scenario, new nuclear and clean coal construction and use soar, supplying nearly 225 gigawatts of capacity (current nuclear capacity is approximately 100 gigawatts).
- Capital cost of clean coal (new coal with capture and storage) is predicted to have average total capital costs of approximately \$4,500 per kW.





# CERA's Global Models

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- Through 2020, any reductions in CO2 emissions from the electricity and heat sector will come from increased use of natural gas, renewables, and a growth in energy efficiency efforts.
- After 2020, reductions might come from increased nuclear generation capacity and carbon capture and storage.



# CERA's Global Models

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- Under the Global Fissures' scenario, the capital for nuclear construction and carbon capture and storage evaporates and there are no meaningful alternatives on the horizon.



# CERA's Global Models

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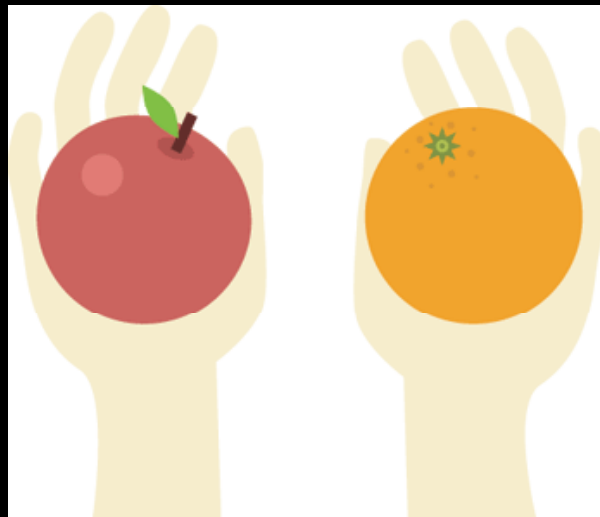
- TAKE AWAY POINT: Any federal legislation should allow for flexibility in the case of severe economic downturn.



# CERA's Global Models

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- Compare CERA's all-in capital costs (2006 \$ per kW) for conventional and currently developing technologies:



# CERA's Global Models

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- Super Critical Pulverized Coal – A tremendous escalation from projected cost of \$1,000 per kW (as of 2006) to over \$3,000 per kW (the higher cost is based upon Duke Energy's North Carolina Cliffside plant expected to be in operation in 2011-2012).
- Integrated Gasification Combined Cycle (IGCC) – Is predicted to be operational in 2013 at a cost up to \$3,500 per kW.



# CERA's Global Models

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- Combined Cycle Gas Turbine (CCGT) – Is currently estimated to cost approximately \$800 to \$1,200 per kW.
- Fluidized Bed Combustion (FBC) – Costs for this emerging technology range from a low of \$1,500 per kW to up to \$3,000 per kW.



# What is the Cost of the U.S. Getting Serious?

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- The amount of per ton CO2 tariff to be enacted by Congress is still subject to great speculation.
  - A minimal (in the legislation's advocates' view) of \$10 per ton CO2 tariff adds about \$10 per mWh to the cost of coal fired generation.
  - This same tariff applied to natural gas carries less than half the impact than that of coal because of natural gas' lower rate of CO2 emissions.



# What is the Cost of the U.S. Getting Serious?

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- For this reason, natural gas is likely to displace coal fired generation in the near-term (before 2016) if CO2 tariffs are enacted.
- The amount of displacement is a function of the amount of the CO2 tariff and the price of natural gas.
- Under CERA's modeling, the least cost case for natural gas (per MMBTU) is \$5 and ranges up to \$8 in 2007 dollars.
- Possible CO2 emissions tariffs in their model range from \$10 to \$40 per metric ton.





# What is the Cost of the U.S. Getting Serious?

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- With \$5 natural gas and a \$40 per ton tariff, there is a 35% displacement of coal (switch to natural gas).
- At the other end of their economic modeling, \$8 natural gas and a \$10 CO<sub>2</sub> per ton tariff produces no coal displacement.



# What is the Cost of the U.S. Getting Serious?

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- **TAKE AWAY:** In the near term a shift from coal to natural gas might look like a dog chasing its own tail.
  - A CO2 tariff will drive a switch from coal to natural gas, creating a shortage of natural gas, driving a switch back to coal.



# What is the Cost of the U.S. Getting Serious?

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- **TAKE AWAY:** In the near term a shift from coal to natural gas might look like a dog chasing its own tail.
  - Only new technologies (nuclear or carbon capture and storage) produce lasting and stable generation choices.



# What is the Cost of the U.S. Getting Serious?

## The Bottom Line:

In order to avoid substantial harm to S.C. in the near term (pre 2020), energy efficiency and moderate CO2 tariffs will have to be key ingredients to any carbon constraint policy.



# Our Message to Congress:

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- Allocate CO2 allowances so that distribution-level utilities can trade, sell, or redeem their allocations to offset spikes in electricity rates caused by CO2 tariffs and volatile natural gas prices.



# Our Message to Congress:

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- The cap must not tighten faster than technology is able to create viable and affordable generation options (clean coal) and the construction of proven non-emittent existing technologies (nuclear).
- Commit some proceeds of any federal auctioning of CO2 allocations to clean coal (storage technology) and nuclear waste storage where real (not “Yucca mountain-type” illusory) results are achieved.

# Our Message to Congress:

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- Congress should check with experts – like CRA and CERA.
- These impartial economic and policy experts sense great risk and limited positive gains coming from the current crop of Congressional proposals.

# Technology Timeline?

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# Again - Ask an Expert

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- The Electric Power Research Institute (EPRI).

The logo for the Electric Power Research Institute (EPRI) features the letters "EPRI" in a bold, blue, sans-serif font. The letters are stylized, with the "E" and "P" having a modern, geometric feel.

ELECTRIC POWER  
RESEARCH INSTITUTE

# EPRI

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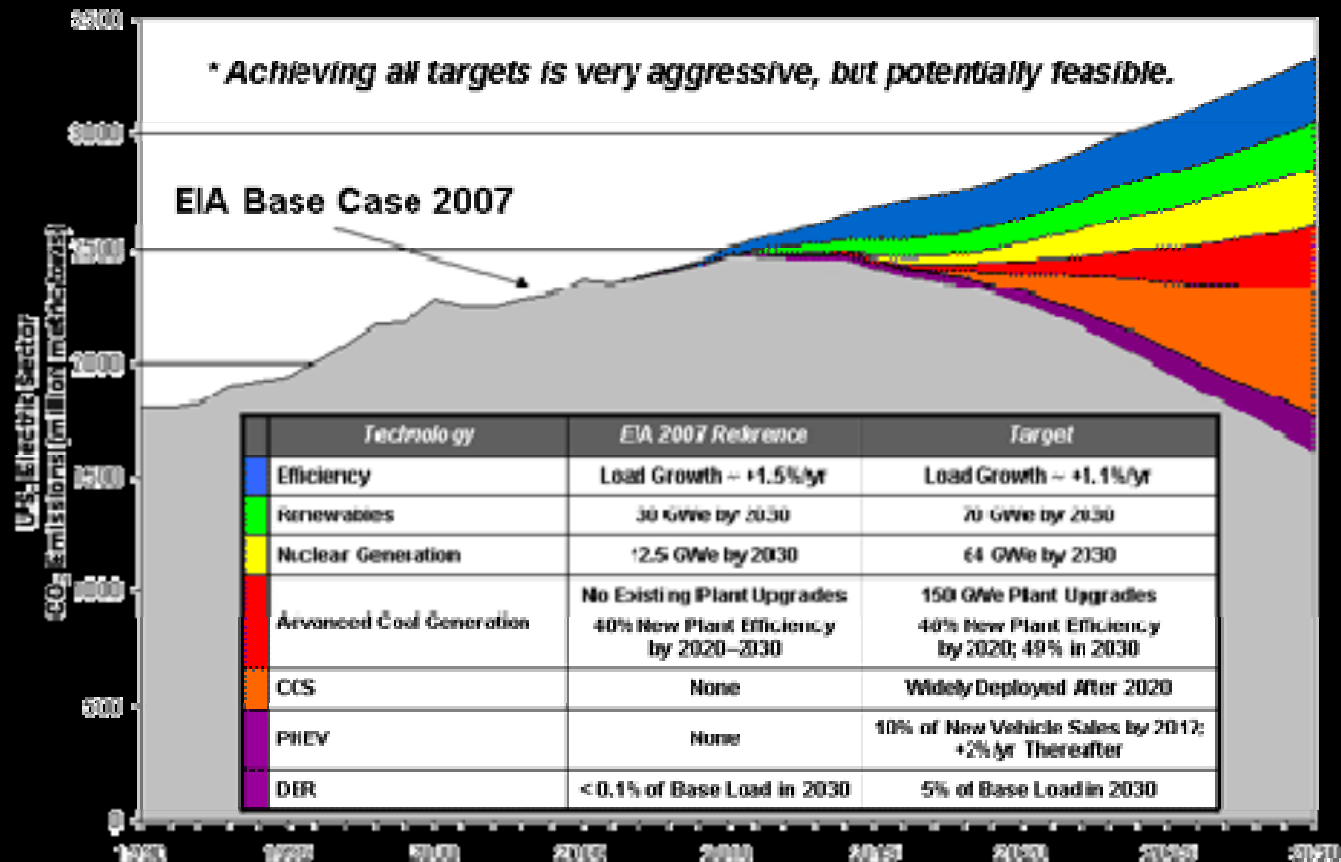
- Founded in 1973 as an independent, nonprofit center for public interest energy and environmental research.
- Focuses on developing technology that offers near and long-term solutions to challenges faced by the electric industry.
- Members generate over 90% of the electricity generated in North America.

# EPRI

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- EPRI conducts, on average, 1,600 research and development projects annually.
- All research is directed to the public benefit.
- Over the past several years, EPRI has made it a priority to supply federal policy makers with guidance as how to time a tightening of proposed CO2 constraints to the availability of technological solutions which lessen CO2 emissions.

# EPRI- Electric Sector CO2 Reduction Potential Prism



# EPRI

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- EPRI CEO Steven Sprecker categorizes “CO2 Solutions” technology advances as being in three stages:
  - 1) early starters - before 2020
  - 2) mid-starters - after 2020 but before 2030 and
  - 3) late starters - after 2030.



# “Early Starter” EPRI Forecasts

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1) With smart grid and advanced communications infrastructure, **efficiency** results in a 9% reduction in base load demand by 2030 largely through slowing growth from 1.5% to 1.1% per year.



## “Early Starter” EPRI Forecasts

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2) If current state renewable portfolio standards (RPS) are met, the total amount of **renewables** will increase by 133% from current estimates. Almost all of this is from wind.



# “Early Starter” EPRI Forecasts

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**3) Plug-in Hybrid Electric Vehicles (PHEV)** will represent 10% of all new vehicle sales after 2017 and will increase by 2% per year thereafter.





# “Mid Starter” EPRI Forecasts

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## 1) New Nuclear Generation

**Construction** accelerates and results in 64 GWe of new generation by 2030 (about 35-40 new nuclear units).



# “Mid Starter” EPRI Forecasts

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## 1) New Nuclear Generation Construction

- Does this seem high?
- Not if one looks back to the 1970s and 1980s when the French actually built more than 40 new units.



# “Mid Starter” EPRI Forecasts

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## 1) New Nuclear Generation Construction

- More unsettling is that Yucca Mountain remains unopened for storage of waste, and
- The projected costs of nuclear generation construction have roughly doubled in the past several years.



# “Mid Starter” EPRI Forecasts

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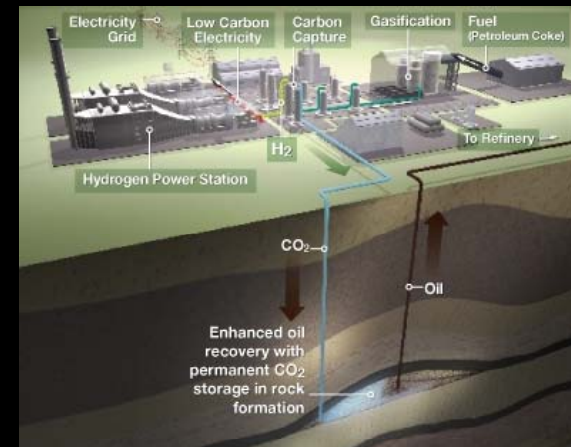
**2) Carbon Capture and Storage** is expected to be widely deployed after 2020.

- After 2020, all new coal plants would capture and store 90% of their CO<sub>2</sub> emissions in deep geological storage.
- This technological advancement is the single largest slice of EPRI's prism.
- Taken away, most of the long-term burden of CO<sub>2</sub> reductions would shift to nuclear, increased energy efficiency, and the use of natural gas.

# “Mid Starter” EPRI Forecasts

## 2) Carbon Capture and Storage

- Why would this technology **not** work?
  - The technology probably will.
  - What may not work is finding financing for the pipeline and storage facilities.
  - Huge liability questions remain - who is responsible for the long-term impact of the stored CO<sub>2</sub>?



# “Mid Starter” EPRI Forecasts

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## 2) Carbon Capture and Storage

- Why would this technology **not** work?
  - Our best hope is for Congress to greenlight and fund pilot projects that would establish “safe harbors” from liability for any future utilization of technology which mirrored the pilot project.



## “Mid Starter” EPRI Forecasts

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- 3) By 2030, **Advanced Coal Generation** should result in up to 50% more efficiency in new coal plants.
- To achieve this move from super-critical to ultra-super-critical generation, much higher temperatures will have to be achieved.
  - There are good prospects for their increased efficiency.

## “Mid Starter” EPRI Forecasts

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- 3) By 2030, **Advanced Coal Generation** should result in up to 50% more efficiency in new coal plants.
- The impact of a carbon cap-and-trade program will be largely dependent on emissions of CO<sub>2</sub> being captured and stored.



# “Late Starter” EPRI Forecasts

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## 1) Renewables

- Key technology challenge - intermittent generation.
- May be resolved through advancements in storage technology.

# “Late Starter” EPRI Forecasts

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## **2) Distributed Energy Resources (DERs)**

- May constitute up to 5% of the nation’s base load in 2030 and grow thereafter if issues of storage are addressed.
- Current technologies limit potential distributed resources like solar, wind, and hydro from being utilized across a broad geographic area.
- Developments may make all of these renewables “S.C. Friendly” at some point (perhaps beyond our lifetimes).

# The Future- Two Scenarios

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## 1) If a full tool box of technologies emerges...

- Conventional coal will be gone by 2040.
- Natural gas use will increase and then wane (after peaking in 2040).
- Electricity is essentially de-carbonized after 2040.



# The Future- Two Scenarios

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2) If the tool box is less than full (no carbon capture and storage, limited new nuclear and a limited number of PHEVs)...

- “Reduced demand” is the name of the game.
- Coal will still be phased out because of the cost of emission tariffs.
- While natural gas takes up some of the slack, biomass will also make big gains.



# The EPRI Price Tag

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- With a full “tool box,” the cost of electricity in real dollars (2008 \$) will increase by 45% by 2050.
- With a less than full “tool box,” cost may increase by 260% by 2050.



# The EPRI Price Tag

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- For S.C., the sky may be the limit without a full tool box.
- With limited nuclear and no coal, and without significant wind or solar to buffer our capacity needs...
- Our members will likely choose between an increase much higher than 260% or going without.

# The Bottom Line

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- What happens after 2017 in terms of supply is largely dependent on whether federal policymakers:
  - 1) Invest in and greenlight new technologies (carbon capture and storage) and provide certainty for investments in existing technologies (i.e. nuclear) and...
  - 2) Tailor any increase in a carbon tax or a tariff in a cap and trade program to advancements in technology.

# Co-ops are Acting Now!

## Current Statewide Initiatives

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- Statewide CFL giveaway (“Do the Light Switch” campaign launches in April; 7 million compact fluorescent light bulbs to co-op members over the next 10 years).
- Net metering programs (buying back power from homeowners who invest in renewable technologies, such as solar power).





# Co-ops are Acting Now!

## Current Statewide Initiatives

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- \$10 million investment in clean coal research (\$5 million from Central Electric & Santee Cooper; \$5 million match from the state).
- PHEV car promotion (Central Electric converting Toyota Prius hybrid to plug-in hybrid; visiting all member co-ops; promoting energy savings, environmental aspect).



# Co-ops are Acting Now!

## Current Individual Co-op Initiatives

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- Free Energy Audits
- Smart Energy Planning
- Good Cents Homes and Buildings
- Low Interest Loans for green technologies
- Green Power offerings

# Questions?

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